

**Before the
Federal Communications Commission
Washington, D.C. 20554**

In the Matter of)	
)	
Amendment of the Commission's Rules with)	GN Docket No. 12-354
Regard to Commercial Operations in the 3550-)	
3650 MHz Band)	

To: The Commission

**COMMENTS OF
Open Technology Institute at the New America Foundation
Consumer Federation of America
Public Knowledge
Free Press**

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February 20, 2013

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The undersigned groups, members of the Public Interest Spectrum Coalition (hereinafter “PISC”), pursuant to Sections 1.415 and 1.419 of the Commission’s Rules, are pleased to submit these comments in response to the proposals and questions in the Notice of Proposed Rulemaking and Order (“*NPRM*”) adopted in the above-captioned proceeding.¹

I. INTRODUCTION AND SUMMARY

The undersigned consumer and media reform groups of the Public Interest Spectrum Coalition (“PISC”) strongly support the Commission’s goal to make “up to 150 megahertz of contiguous spectrum available for innovative mobile and fixed broadband services without displacing mission-critical incumbent systems.”² A Citizen’s Broadband Service based generally on the three-tier framework recommended by the President’s Council of Advisors on Science and Technology (PCAST) is potentially a landmark in the Commission’s progress away from static “command and control” licensing rules and toward more flexible and spectrum-efficient

¹ *Amendment of the Commission’s Rules with Regard to Commercial Operations in the 3550-3650 MHz Band*, Notice of Proposed Rulemaking and Order, GN Docket No. 12-354 (rel. Dec. 12, 2012) (hereinafter “*NPRM*”).

² *Id.* ¶ 1.

approaches that begin to harness the full potential of the nation's spectrum resource. We applaud the Commission's effort to convert a very substantial but grossly underutilized swath of spectrum into an intensively-used small-cell band in a manner that not only protects military and other incumbent systems from interference, but also builds a foundation for more extensive private sector sharing of underutilized bands with an automated governing mechanism (a "Spectrum Access System").

As an initial matter, PISC urges the Commission to keep the technical rules and operating requirements for shared use of the 3.5 GHz band as simple and flexible as possible. This will encourage standardization and mass deployment. For example, PISC believes the Commission's proposal to define one common set of technical rules for both Priority Access (PA) and General Authorized Access (GAA) uses is an important step in this direction. We also recommend that even if shared access were to be licensed by rule under Part 90, the power limits and other technical rules for small cell use should be as compatible as possible with the Part 15 rules that currently govern the most popular, numerous, and successful implementation of shared small cell technology, particularly with respect to the 2.4 GHz band. The regulatory regime here should define some basic rules of the road – principally to ensure that the Spectrum Access System will operate automatically to protect federal incumbent systems – and then get out of the way. There should be as few technical hurdles as possible in the path of a potential integration of the 3.5 GHz band into the family of standards that facilitate widespread use of the existing small cell unlicensed bands.

Section 307(e) of the Communications Act is designed precisely for services like the proposed Citizen's Broadband Service where a high degree of frequency sharing and re-use is anticipated and licensing by rule can enable direct access to the public airwaves by individual

consumers who purchase devices capable of communicating without need for an intermediary, wide-area network. While Part 15 is a preferable basis for opportunistic access in this band, most important is that all small-cell users are subject to the same technical requirements (e.g., transmit power and OOB limits) to encourage markets for chips, devices, applications and services with greater economies of scale.

With respect to Incumbent Access, PISC strongly supports the Commission's proposal that "the calculation of Incumbent Use Zones should be designed to prevent commercial interference into radar, not interference from DoD radar into commercial systems."³ We recommend that the Commission define geographic exclusion zones for GAA users based *only* on the separation distances essential to protect Incumbent Access systems from harmful interference and permit a combination of the SAS, private sector technical innovation and consumer choice to determine what level of interference risk to commercial systems is tolerable.

With respect to Priority Access, if the Commission decides to grant certain users interference protection, PISC proposes this should be limited initially to indoor-only use and allocated no more than 50 megahertz at the bottom of the band. The remaining 100 megahertz (including integration of the 3650-3700 MHz band under common rules) could be used on a potentially contiguous basis by GAA users for small-cell and, outside of urban areas, higher-power uses compatible with today's 3650-3700 MHz "light licensing" rules. In addition, eligibility should be strictly limited to "mission critical" *uses* (not users) related directly to critical infrastructure and community anchor institutions. Finally, PISC believes that \ exclusion zones around Priority Access sites should not be enforced preemptively by the SAS to protect Priority Access users from harmful interference, and should instead be remedial in nature if and when attempts to resolve actual harmful interference are unsuccessful.

³ *NPRM* at ¶ 116.

With respect to General Authorized Access, PISC supports the Commission's proposal to define geographic exclusion zones for GAA users based *only* on the separation distances essential to protect Incumbent Access systems from harmful interference. At a bare minimum, the Commission should permit devices and systems to operate inside the coastal exclusion zones if such devices and systems can detect Navy radar and employ Dynamic Frequency Selection to hop instantly to another portion of the band (or to a different band, such as 2.4 GHz or 5 GHz unlicensed spectrum), or if they can make the same "hop" based on notification from a near real-time SAS. GAA users should be able to operate across the entire 150 megahertz of the combined band, limited only by preemptive exclusion zones needed to protect Incumbent Access use and by remedial protection zones, where necessary, to protect health and safety Priority Access uses that experience harmful interference. It is essential to ensure that a majority of the band (100 MHz or more) is available nationwide for at least low-power (small cell) GAA use – and, where possible, outside of urban areas for high-power (wide area) GAA use.

PISC strongly opposes a two-tier model under which General Authorized Access would not be permitted. The need for and feasibility of this approach is unproven. It would be far less spectrum efficient, and impose enormous opportunity costs compared to the Commission's proposal to include an underlay of General Authorized Access on an opportunistic basis.

PISC supports the Commission's proposal to extend the proposed regulatory framework for the Citizen's Broadband Service up to 3700 MHz, creating a contiguous 150 MHz block of spectrum under the same license-by-rule approach. PISC strongly supports the Commission's proposal to reclassify current 3650-3700 MHz band licensees as General Authorized Access users able to operate across the entire 150 MHz of the band, including at the power levels currently allowed in the 3650 MHz band in Higher Power Operation Zones.

II. THE SPECTRUM EFFICIENCY AND ECONOMIC BENEFITS OF SMALL CELL TECHNOLOGIES IN SHARED BANDS IS WELL DOCUMENTED

As the *NPRM* observes, although the Commission's efforts have focused primarily on clearing bands for "traditional, exclusive licensing uses . . . it has become increasingly clear that such efforts alone will not suffice to meet the growing demand for commercial wireless spectrum."⁴ Perhaps the most consequential contradiction in telecommunications policy today is the gap between claims of a "looming spectrum crisis"⁵ and the reality that only a fraction of the nation's prime spectrum capacity is actually in use even in the most congested urban areas.⁶ While unused spectrum capacity is abundant, there is little question that consumer demand for wireless data – and mobile carrier need for spectrum capacity – is growing rapidly.⁷

The proliferation of wireless devices, particularly data-intensive smartphones and tablets, has changed the nature of wireless communications. Demand for wireless data is growing faster than the capacity of mobile carriers' licensed networks. Carriers offering wide area service over

⁴ *NPRM* at ¶ 34; accord Executive Office of the President, President's Council of Advisers on Science and Technology, *Realizing the Full Potential of Government-Held Spectrum to Spur Economic Growth*, Report to the President, at vi (July 2012) (hereinafter "PCAST Report"), which concludes that clearing and reallocating Federal spectrum for exclusive commercial use is not a sustainable strategy over time.

⁵ FCC Chairman Julius Genachowski first warned of a "looming spectrum crisis" in an Oct. 6, 2009 speech to CTIA, the wireless industry trade association. Prepared Remarks of FCC Chairman Julius Genachowski, "America's Mobile Broadband Future," Int'l CTIA Wireless I.T. and Entertainment Conference, October 7, 2009 ("I believe that the biggest threat to the future of mobile in America is the looming spectrum crisis"); available at http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-293891A1.pdf. See also Remarks of FCC Chairman Julius Genachowski, 2012 Consumer Electronics Show (Jan. 11, 2012) ("America's global leadership in mobile . . . is being threatened by the looming spectrum crunch."); available at <http://www.fcc.gov/document/chairman-genachowski-2012-consumer-electronics-show>.

⁶ Multiple National Science Foundation studies of actual spectrum occupancy measurements over both short- and long-term periods demonstrate that even in extremely high-demand areas such as Manhattan, downtown Chicago and Washington, D.C. near the White House, less than 20 percent of the frequency bands below 3.1 GHz are in use over the course of a typical business day. See, e.g., Dennis Roberson, *et al.*, "Long-term Spectrum Occupancy Findings in Chicago," Illinois Institute of Technology, at p. 4 (2011); Mark McHenry, "NSF Spectrum Occupancy Measurements: Project Summary," Shared Spectrum Company (Aug. 2005) ("McHenry 2005 Study"), available at <http://www.sharespectrum.com/measurements/>; Mark McHenry, "Dupont Circle Spectrum Utilization During Peak Hours, A Collaborative Effort of The New America Foundation and The Shared Spectrum Company," New America Foundation Issue Brief (2003), available at http://www.newamerica.net/files/archive/Doc_File_183_1.pdf. More detail on these findings is provided below.

⁷ See, e.g., Federal Communications Commission, *Mobile Broadband: The Benefits of Additional Spectrum*, Omnibus Broadband Initiative, Technical Paper No. 6, at pp. 2, 5 (Oct. 2010) ("OBI Paper").

centrally provisioned infrastructure are beginning to approach the physical limits of exclusive-licensed models even with the latest 4G technologies. LTE, the latest and most advanced carrier technology will be outpaced by demand.⁸ The ITU spectrum requirements study that formed the basis for CTIA's petition in 2009, which suggested that an additional 800 MHz of exclusively licensed spectrum was needed to meet projected demand, assumed that LTE in 2020 would already be at 75 percent of the theoretical limits imposed by Shannon's Law – and yet still less efficient than Wi-Fi "hot spots."⁹ Given this reality, it seems clear that traditional models – that is, exclusive-licensed, macrocell networks – will not satisfy the growing demand for wireless data.

Meeting the demand for mobile data will ultimately require a greater focus on shared and dynamic access to unused and underutilized bands. Carriers utilizing the existing commercial wireless business model – based on exclusive licensing, high-power transmission, wide area coverage, very limited spectrum re-use, centralized infrastructure and metered billing – will continue to need more exclusive-use spectrum in the short-run to meet this demand. However, it should be equally clear that this model is not sustainable. As the President's Council of Advisors on Science and Technology (PCAST) observed in their 2012 report focused on underutilized Federal spectrum bands, "[c]learing and reallocation of Federal spectrum for exclusive use is not a sustainable basis for spectrum policy due to the high cost, lengthy time to implement, and disruption to the Federal mission."¹⁰

⁸ A Rysavy Research report cited by CTIA in its petition for 800 MHz noted that although LTE technology will be up to three times more spectrum efficient than 3G (EV-DO and UMTS/HSPA), "there are both theoretical and practical limits to spectral efficiency and current systems are approaching those limits." Rysavy Research, "Mobile Broadband Spectrum Demand," at 19 (Dec. 2008), submitted as attachment to CTIA Sept. 29, 2009 *Ex Parte* letter, *supra* note 6.

⁹ *Id.* at 14, 19. See ITU, *Estimated spectrum bandwidth requirements for the future development of IMT-2000 and IMT-Advanced* (2006).

¹⁰ PCAST Report at 73. See also U.S. Department of Commerce, *An Assessment of the Near-Term Viability of Accommodating Wireless Broadband Systems in the 1675-1710 MHz, 1755-1780 MHz, 3500-3650 MHz, and 4200-*

John Chapin (now at DARPA) and MIT economist William Lehr have argued that the supposed spectrum shortage stifles competition and encourages industry consolidation by raising costs for deploying competitive 4G broadband. They surmise that it will be "impossible" to maintain current levels of competition simply by allocating more exclusively-licensed spectrum.¹¹ Unless business models change, competition in high-value wireless services will continue to stagnate, such that some markets will only be able to support one viable operator. Instead, they suggest that "the key leverage available at the system architecture level is to reduce cell size."¹² Smaller cells increase the efficiency of scarce spectrum resources, and make possible the productive use of frequencies above 3.1 GHz for broadband. Most critically, low-power, small cell devices enable spectrum sharing.¹³ According to Chapin and Lehr, "*the denser the cells, the more spectrum sharing is possible.*"¹⁴ They conclude that "[a]ggressive cell size reduction... provides the key technical leverage for escaping the collision between demand growth and limited spectrum resources."¹⁵

Unlike macrocell networks, which can quickly become overwhelmed, small cell networks are ideally suited to handle large influxes of users. According to a Wireless Broadband Alliance report, in 2012 both the London Olympics and the Super Bowl successfully deployed extensive

4220 MHz, 4380-4400 MHz Band, October 2010, available at http://www.ntia.doc.gov/files/ntia/publications/fasttrackevaluation_11152010.pdf

¹¹ John M. Chapin, William H. Lehr, "Mobile Broadband Growth, Spectrum Scarcity, and Sustainable Competition," (paper prepared for the 39th Research Conference on Communication, Information and Internet Policy, Arlington, VA, September 23-25, 2011) at 3 (hereinafter "Mobile Broadband Growth, Spectrum Scarcity and Sustainable Competition").

¹² Mobile Broadband Growth, Spectrum Scarcity and Sustainable Competition at 1.

¹³ *Id.*

¹⁴ *Id.* at 25.

¹⁵ *Id.* at 7.

Wi-Fi networks (that is, small cell unlicensed) to handle the sudden increase in data demand by tens of thousands of mobile device users in very congested arenas and areas.¹⁶

Hybrid Networks and Mobile Device Data Offloading

As PISC has asserted in comments filed during the National Broadband Plan proceeding and since, it is neither cost-effective nor optimal for consumer welfare to encourage an ultimately unsustainable model in which mobile data is transported predominantly over exclusively-licensed airwaves and carrier-provisioned infrastructure.¹⁷ Hybrid and heterogeneous networks – combining licensed and more short-range shared and/or unlicensed spectrum – are the most feasible solution to the increased demand for video and other bandwidth-intensive applications on mobile devices. Both spectrum re-use and backhaul will increasingly be more cost-effective at the edge of the network, closest to the end-user and subject to their control (or, more practically speaking, determined on the fly by software in their device).

It is critical to distinguish between truly *mobile* data demand (e.g., in a car or hiking in the woods) and *nomadic* data demand (e.g., streaming video or music in a home, office or public space). As discussed in more detail below, the rising consumer demand for data on mobile devices, especially smartphones and tablets, is primarily nomadic and can be most efficiently met by offloading data traffic onto wired local area networks (such as home or business Wi-Fi connections), rather than relying on transmission over exclusively-licensed spectrum to more distant carrier-provisioned infrastructure. As a result, spectrum efficiency and consumer welfare would be optimized by hybrid networks that carry most wireless device data over short distances,

¹⁶ WBA Wi-Fi Industry Report 2012

¹⁷ See Comments of the Public Interest Spectrum Coalition, “In the Matter of Promoting More Efficient Use of Spectrum Through Dynamic Spectrum Use Technologies,” ET Docket No. 10-237 (filed Feb. 28, 2011); Reply Comments of the Public Interest Spectrum Coalition, In the Matter of Fostering Innovation and Investment in the Wireless Communications Market; A National Broadband Plan for Our Future, GN Docket Nos. 09-157, 09-51 (filed Nov. 5, 2009).

at low power, using virtually unlimited unlicensed and shared spectrum capacity within and between wireline local area networks. To achieve pervasive connectivity at affordable prices, while preserving competition in mobile markets, it is imperative to pursue small cell spectrum sharing strategies in parallel with other efforts to increase the amount of exclusively-licensed spectrum available for more wide-area offerings.

Carriers are already benefitting from substantial cost savings when consumers offload what would otherwise be mobile network traffic over unlicensed spectrum using the consumers' own self-provisioned networks and wireline Internet connections. In a 2012 study for the Consumer Federation of America, economist Mark Cooper estimated that by 2010 carriers had avoided building 130,000 new cell sites due to Wi-Fi offloading, "lowering the cost of cellular broadband service substantially, with savings on the order of \$20 billion per year, which is a substantial savings in a market with annual revenues of \$70 billion."¹⁸ Cooper also values the explosive growth in the number of Wi-Fi hotspots available, estimating the value of hot spot connectivity to be an "extremely conservative... \$10 billion per year and growing."¹⁹ Similarly, Cisco's Internet Business Solutions Group has estimated that by embracing hybrid networks (small cell and shared spectrum), carriers can lower operating costs by as much as 25%.²⁰

Carriers worldwide are embracing this reality and typically doing so to a far greater degree than in the United States. Wi-Fi offloading has become an industry standard, as "18 of the world's top 20 largest telcos by revenue have now publicly committed to investing in deploying

¹⁸ Comments of Consumer Federation of America, *In the Matter of Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions*, Notice of Proposed Rulemaking, FCC 12-118, Docket No. 12-268 (January 25, 2012), at 2, updating key findings from its previously published study on the economics of Wi-Fi offloading. See Mark Cooper, *Efficiency Gains and Consumer Benefits of Unlicensed Access to the Public Airwaves: The Dramatic Success of Combining Market Principles and Shared Access*, Consumer Federation of America (January 2012).

¹⁹ See Cooper, *id.*, at 19

²⁰ Stuart Taylor, "A New Chapter for Mobile? How Wi-Fi Will Change the Mobile Industry as We Know It", Cisco Internet Business Solutions Group, November 2011 at 5; *available at* <http://www.cisco.com/web/about/ac79/docs/sp/New-Chapter-for-Mobile.pdf>.

their own Wi-Fi Hotspot networks.”²¹ Similarly, carriers worldwide increasingly rely on small cells (such as femtocells and picocells) to meet the growing demand in dense urban environments. The worldwide cost savings to mobile operators is estimated to reach a cumulative \$250 billion over the next four years.²²

It's estimated today that despite the ongoing rollout of 4G LTE services, offloading to Wi-Fi and femtocells will continue to grow, accounting for as much as 30-to-60 percent of total traffic from 3G and 4G networks by 2015.²³ Similarly, by 2015 commercial Wi-Fi networks will carry more data than all mobile networks did in 2010, according to Wireless Broadband Alliance data.²⁴ Reporting on the trend, the business research group ACCURIS sums up this fundamental shift in carriers' approach to spectrum access in the following way:

Operators' perceptions of Wi-Fi have changed from seeing the technology as a threat that was stealing traffic and revenue to a significant opportunity for growing data services usage. The full integration of Wi-Fi with mobile networks is critical to an operator's success. Not just for authentication and data but for all the services the end users currently receive on cellular networks as well as those they are likely to in the future, including billing, voice, messaging and roaming.²⁵

In this proceeding, focused on the 3550-3700 MHz bands, we applaud the Commission's effort to convert a very substantial but grossly underutilized swath of spectrum into an intensively-used small-cell band in a manner that not only protects incumbent military and other primary systems from interference, but which also builds a foundation for more extensive private sector sharing of underutilized bands with an automated governing mechanism (a “Spectrum Access System”).

²¹ WBA, Wi-Fi Industry Report (2012).

²² Richard Thanki, *The Economic Significance of Licence-Exempt Spectrum to the Future of the Internet*, at 9 (June 2012).

²³ Wireless Broadband Alliance, "Next Generation Hotspot Whitepaper: Maintaining the Profitability of Mobile Data Services", October 2012 at 5.

²⁴ *Id.*

²⁵ ACCURIS, “Why Wi-Fi uploading and roaming are key to meeting growing data demands”

III. PISC SUPPORTS THE COMMISSION’S PROPOSED THREE-TIER FRAMEWORK

PISC supports with some qualifications the Commission’s proposal to establish a three-tier license-by-rule framework for the 3550-3700 MHz band. Although we believe the public interest would be equally or better served without any separate Priority Access tier in this particular band, and with General Authorized Access codified under Part 15, we recognize too that the proposed licensing by rule would “allow for a more unified authorization framework for multiple tiers of users that might otherwise fall under different parts of the Commission’s rules.”²⁶

Section 307(e) of the Communications Act is designed precisely for services like the proposed Citizen’s Broadband Service, where a high degree of frequency sharing and re-use is feasible and where licensing by rule can enable direct access to the public airwaves for individual consumers purchasing devices capable of communicating without need for an intermediary, wide-area network. We agree with the NPRM that a license-by-rule regulatory framework “would facilitate the rapid deployment of compliant small cell devices” while “minimizing administrative costs and burdens on the public, licensees and the Commission.”²⁷ The most obvious examples are various other Citizens Band Radio Services, including the Family Radio Service and the Wireless Medical Telemetry Service. Indeed, the proposed Citizen’s Broadband Service is properly viewed as the advanced wireless analog of traditional Citizens Band Radio Services, allowing two-way communication between citizens that is digital, Internet-enabled and potentially high-capacity rather than merely voice, analog and narrowband.

Perhaps the most important outcome of this proceeding is ensuring that all small-cell users are subject to the same technical requirements (e.g., transmit power and OOB limits) to

²⁶ *NPRM* at ¶ 11.

²⁷ *Id.* at ¶ 62.

encourage markets for chips, devices, applications and services with greater economies of scale. PISC urges the Commission to keep the technical rules and operating requirements for shared use of the 3.5 GHz band as simple and flexible as possible. This will encourage standardization and mass deployment. For example, PISC believes Commission's proposal to define one common set of technical rules for PA and GAA uses is an important step in this direction. We also recommend that even if shared access were to be licensed by rule under Part 90, the power limits and other technical rules for small-cell use should be as compatible as possible with the Part 15 rules that currently govern the most popular, numerous and successful implementation of shared small-cell technology, particularly with respect to the 2.4 GHz band.

The Commission is also correct to choose a license-by-rule framework where, as here, the public interest purposes of the band can be achieved without more restrictive licensing. Generally, First Amendment principles suggest that the government must have a good reason to abridge the ability of individual citizens to communicate by assigning exclusive licenses to government-controlled spectrum.²⁸ This is particularly salient where the communication is strictly over the airwaves and inside structures located on private property. The federal government's authority to regulate access to spectrum has been upheld for the purpose of avoiding mutual and harmful interference that would destroy the utility of the resource. Thus, for many purposes, exclusive licenses that constitute "third-party control" over the airwaves, even indoors, can serve the larger public interest. However, in the case of a frequency band that is for good reason limited to small cell and low-power use – and where over short distances radios owned or approved by property holders will communicate most effectively by connecting

²⁸ See, e.g., Harold Feld, "From Third Class Citizen to First Among Equals: Rethinking the Place of Unlicensed Spectrum in the FCC Hierarchy," COMMLAW CONSPECTUS, Vol. 15 (2006) ("[G]iven the strong First Amendment and public policy benefits of creating a world in which all citizens can speak through the public airwaves, rather than one in which the public must rely on a handful of government-licensed intermediaries, the FCC should make every effort to foster the development of technologies that facilitate non-exclusive unlicensed use." *Id.* at 55-56.)

directly to wireline broadband backhaul also provisioned by the property holder – the Commission should not presume that exclusive licensing is the appropriate regulatory framework for “first person control” by the end user or, if the risk of harmful interference is not compelling, by the public generally under Part 15 unlicensed rules.

Particularly with respect to unused capacity on federal spectrum bands, as Columbia University Professor Eli Noam wrote over a decade ago, the government has an obligation not to create any unnecessary barriers to citizen communication over government-controlled conduits such as the airwaves:

[S]pectrum access is traffic control, not real estate development. It’s about flows, not stocks. . . . The emergence of technologies that make it possible for multiple users of spectrum to cohabit and move around frequencies has profound effects. It is not just that it is arguably a more efficient system . . . More importantly, it is *constitutionally* the stronger system. . . . Electronic speech is protected by the First Amendment’s Free Speech Clause. Therefore the state may abridge it only in pursuance of a “compelling state interest” and through the “least restrictive means” that “must be carefully tailored to achieve such interest.”²⁹

A. Tier 1: Incumbent Access

PISC generally agrees with the Commission’s proposal to create an Incumbent Access tier that would guarantee primary federal and grandfathered FSS commercial users protection from harmful interference enforced automatically by the SAS. The three-tier approach to opening underutilized federal bands for sharing by the private sector, as the PCAST recommended, has the potential to be extended to a number of other federal bands between 2.7 and 3.7 GHz *only* if the Commission establishes rules in this proceeding that can reasonably protect sensitive federal operations, particularly those related to national security.

²⁹ Eli Noam, “Yesterday’s Heresy, Today’s Orthodoxy, Tomorrow’s Anachronism: Taking the Next Step to Open Spectrum Access,” 41 *Journal of Law & Economics* 765-90 (1998), available at <http://www.citi.columbia.edu/elinoam/articles/SPECTRM1.htm>; see also Eli Noam, “Taking the Next Step Beyond Spectrum Auctions: Open Spectrum Access,” *IEEE Communications*, Vol. 33(12) (Dec. 1995).

The PCAST report emphasized that one of the advantages of using an SAS is that, like the TV Bands Database, a dynamic geolocation database solution not only ensure protection of current federal operations, but also accommodate changes in the technologies or needs of federal incumbents. It can do so by ensuring that private sector users (in this case PA and GAA networks and devices) are able to update their firmware and/or vacate a particular subchannel of the band as the needs of federal incumbents evolve. Although in some cases federal users will be able to transition off a frequency band over time, in a larger number of bands they will continue to operate with technologies and architectures that evolve along with their needs. The PCAST stated:

[W]hen Federal bands are opened for shared access, it is essential both to safeguard Federal systems, especially in bands with national security and public safety uses, and also to permit these Federal systems and uses to evolve without being hamstrung by commercial or consumer uses that cannot accommodate changes in the conditions governing secondary access.³⁰

As a result, any Priority and General access authorized in this proceeding should be considered contingent with respect to any particular frequency or location and should dispel any expectation that the SAS will not impose changes in the “rules of the road” in the future, depending on the needs of critical federal systems and other factors. Any attempt by the Commission to “freeze” the ability of federal primaries to adapt to changing needs, particularly with respect to national security systems, will only serve to discourage robust sharing of this and other bands.

We also concur with the recommendation by PCAST that a foundational element for shared use is a registration of Federal incumbent systems in the SAS that “should be detailed, up-to-date and, as far as possible, transparent to the public,” while recognizing that there needs to be

³⁰ PCAST Report at 100.

“exceptions to the transparency requirement for information pertaining to classified uses.”³¹ It is critical that the SAS make all information about uses and users of the band transparent to industry and the general public to the greatest extent possible and consistent with national security.

With respect to defining the geographic exclusion zones that would be necessary to protect Incumbent Access operations, PISC believes it is imperative that the Commission distinguish between potential interference *to* and *from* federal systems, particularly with respect to high-power Navy radars. As the *NPRM* recounts, the NTIA’s Fast Track Report, based on an assumption that the 3550-3650 MHz band would be licensed for wide-area mobile WiMAX networks, recommended coastal exclusion zones that on average extend as much as 450 kilometres inland, thereby excluding geographies where 60 percent of the U.S. population resides.³²

However, coastal exclusion zones are apparently not needed to protect Navy radar from low-power terrestrial use. They were based instead on an assumption that exclusion zones were needed to protect mobile WiMAX handsets and base stations *from* high-power radar pulses. This may have been a reasonable assumption in the context of an NTIA Fast Track analysis that focused on whether the 3550-3650 MHz band had sufficient auction value as a licensed commercial mobile network based on current carrier business models. Yet, PISC believes it is a counterproductive assumption with respect to opportunistic GAA uses that will generally operate on a contingent and best-efforts basis with no interference protection rights. We agree with the *NPRM* that GAA users can operate inside coastal exclusion zones because they “should not have

³¹ PCAST Report at 26.

³² *NPRM* at ¶ 114; *see* NTIA, Fast Track Report, at 4-36 to 4-72 (2010).

any expectation of interference protection and would be required to accept interference from Incumbent Access users, including DoD radar systems.”³³

In subsection 3 below, in the discussion of GAA, PISC therefore strongly supports the Commission’s proposal that “the calculation of Incumbent Use Zones should be designed to prevent commercial interference into radar, not interference from DoD radar into commercial system[s].”³⁴ We recommend that the Commission define geographic exclusion zones for GAA users based *only* on the separation distances essential to protect Incumbent Access systems from harmful interference – and permit a combination of the SAS, private sector technical innovation and consumer choice to determine what level of interference risk to commercial uses is tolerable. At a minimum, the Commission should permit devices and systems to operate inside the coastal exclusion zones if they can detect DoD radar or use a geolocation database notification, and then employ Dynamic Frequency Selection to hop to another portion of the band (or to a different band, such as 2.4 GHz or 5 GHz unlicensed spectrum).

B. Tier 2: Priority Access

The Commission proposes to authorize low-power (small cell) use for “mission critical” use indoors on a Priority Access basis.³⁵ PISC groups are extremely reluctant to see this very promising band balkanized by an experiment with Priority Access for a limited subset of users with interference protection against opportunistic uses (even though it shouldn’t actually be needed for indoor operations at this frequency range and at 200 milliwatts of power).

Nevertheless, if the Commission decides to grant a Priority Access tier of users protection, this must be limited to indoor-only use and allocated no more than 50 megahertz at the bottom of the band, so that the remaining 100 megahertz can be used on a contiguous basis

³³ *NPRM* at ¶ 116.

³⁴ *Id.* at ¶ 116.

³⁵ *Id.* at ¶ 73.

by GAA users for small-cell and, outside of urban areas, higher-power uses compatible with today's 3650-3700 MHz "light licensing" rules. In addition, PA eligibility should be strictly limited to "mission critical" *uses* (not users) related directly to critical infrastructure and community anchor institutions. Finally, PISC believes that no exclusion zones should be imposed preemptively to protect Priority Access users from potential harmful interference, and that they should be imposed only after attempts to resolve actual harmful interference are unsuccessful.

1. Priority Access Should be Limited to a Portion of the Band for Indoor Use Only

PISC believes that a Priority Access tier that is licensed by rule under Section 307(e), without an auction or user fees, and with protection against interference from opportunistic "General Authorized Access" users, is justified *only* if it is limited to indoor use by institutional users with "critical quality-of-service needs," as proposed in the *NPRM*.³⁶ Although it is unclear where to draw the line with respect to eligibility as a "mission critical" user (or use), we believe there are several reasons why the Commission has proposed precisely the right balance between meeting the distinct needs of a subset of critical users and still achieving the tremendous potential for spectrum re-use and innovation that could result from General Authorized Access on a band-wide and nationwide basis.

First, any grant of Priority Access Rights for outdoor or wide-area use could require competitive bidding. Section 309(j)(2) of the Act requires the Commission to assign licenses by competitive bidding whenever applications for spectrum use are mutually exclusive unless an

³⁶ *NPRM* at ¶¶ 55, 56, 59.

express exemption applies.³⁷ If, as the *NPRM* proposes, Priority Access confers a degree of interference protection against General Authorized Access users, then the Commission might need to assume that outdoor and wide-area deployments (e.g., via meshed networks or in High Power Zones) will create the need for mutually exclusive assignments of rights. An alternative two-tier framework that is exclusively licensed with no opportunistic access could avoid this problem; but that would entail an enormous opportunity cost, as discussed further below (with respect to the Qualcomm two-tier proposal), since it is nearly certain that parties seeking to purchase exclusive licenses to Priority Access would only be interested in providing service in a handful of the most congested urban areas, leaving the band fallow in 90 percent or more of the country.

Second, as noted just above, Priority Access rights limited to non-interfering use indoors, on a user's own property, and in a manner that minimizes restrictions on opportunistic use of the band outside the structure, is most aligned with both First Amendment principles and with maximizing spectral re-use in all locations.

Third, limiting Priority Access to a portion of the band for indoor use only, as the *NPRM* proposes, ensures at least the possibility of a robust GAA market for more general-purpose devices and services with nationwide scope and scale. If spectrum access for the general public – and for small-cell offload in particular – resembles a Swiss cheese riddled with holes with no connectivity, it is far less likely that chip, device and app makers will invest in populating the band. And, even if they do, the market will be far smaller, pricier and less productive than it could be if it more closely resembled the 2.4 GHz unlicensed band, which is at least known to be available for use anywhere and everywhere even in locations where it may become congested.

³⁷ Section 309(j)(2) of the Act specifies only three types of licenses that are exempt from the auction process: (1) licenses for public safety radio services; (2) initial licenses for digital television service, and (3) licenses for non-commercial educational broadcast stations and public broadcast stations.

With respect to the portion of the band that should be available for Priority Access, PISC agrees with the Commission's proposal to initially designate only a portion of the band for this purpose. While the enormous benefits of shared, opportunistic access on unlicensed bands has been well proven and documented (the 2.4 GHz band in particular), as described in Section I above, the Commission has no reasonable certainty that there will be a robust market for Priority Access in limited locations and, if there is, that it won't undermine the broader market for GAA. PISC therefore recommends that the Commission designate no more than 50 megahertz of contiguous spectrum for Priority Access – and that such a substantial allocation should be made only if GAA is available across the entire band, including in Priority Access Zones, subject to protections for both Incumbent Access and Priority Access operations. We concur that this approach will provide adequate capacity to test market demand and uptake. And given the contingent and flexible nature of the Spectrum Access System, the Commission can decide to revisit and revise this number up or down in the future without disrupting GAA operations (which would adjust automatically to the spectrum available by location).

PISC further suggests that Priority Access should be located at 3550-3600 MHz only, at the lower end of the band furthest away from the High Power Operation Zones that have proven most valuable for rural broadband deployments in rural and small town areas. While today the nation's roughly 2,000 wireless Internet service providers (WISPs) are restricted to the "lightly licensed" 3650 MHz band, as we discuss further below, PISC recommends that the Higher Power Operation Zones extend GAA for WISPs and other fixed access services across the entire 3550 to 3700 MHz band, with the exception of appropriate exclusion zones for registered Incumbent Access and Priority Access users. Since it is clearly in the public interest to provide as much contiguous spectrum as possible to rural broadband providers operating on a higher-

power GAA basis, the Priority Access Zones should be restricted to 50 megahertz or less in the lowest portion of the band.

Finally, PISC agrees with the Commission’s proposal that a “[r]eservation of frequencies for Priority Access use in a given location would occur only while Priority Access users are actually operating, ensuring that Priority Access spectrum would be available for GAA users when systems are not in use.”³⁸ It will be important for the Commission to include provisions in the rules that require Priority Access users to specify their *actual use* in the SAS (particularly when planned use is limited to certain days or certain hours of the day), to update their registration periodically to keep the reservation accurate, and to notify the SAS of any discontinuance of service so that the spectrum can be freed up for more general use, even if only temporarily.

2. Priority Access should initially be limited to ‘mission critical’ infrastructure, public safety and community anchor institutions

PISC agrees fully with the *NPRM* that it is infeasible and inefficient to go back to the practice of granting individual industries (e.g., transportation, utilities, health care, manufacturing) their own exclusive bands of spectrum.³⁹ Since the 3.5 GHz band can be made available to most of the population on a small-cell basis, it is entirely possible to meet certain critical quality-of-service needs without excluding opportunistic use of the band more generally. At the same time, PISC agrees that at least initially, Priority Access should be limited to truly “mission critical” users that have a compelling public interest requirement for “quality-assured operations” within their facilities.⁴⁰ Since most of these institutions and sites will be stand-alone structures set off in most cases from individual households and office buildings, PISC believes

³⁸ *NPRM* at ¶ 72.

³⁹ *Id.* ¶ 73.

⁴⁰ *Id.*

that on a strictly indoor basis they could be given remedial protection from actual and harmful interference.

The *NPRM* requests comment on the “ideal scope of the eligible class of users.”⁴¹

Although we are unaware of any existing definition that fits this situation perfectly, a useful foundation is the definition of a Critical Infrastructure Industry set forth in Part 90.7 of the Commission’s rules:

Critical Infrastructure Industry (CII). State, local government and non-government entities, including utilities, railroads, metropolitan transit systems, pipelines, private ambulances, volunteer fire departments, and not-for-profit organizations that offer emergency road services, providing private internal radio services provided these private internal radio services are used to protect safety of life, health, or property; and are not made commercially available to the public.⁴²

Since this definition is oriented toward critical industries that relate directly to public safety, the Commission should consider expanding it somewhat to include, in particular, other community anchor institutions (hospitals, schools and certain other state and local government facilities) as well as any indoor federal government facility with a bona fide quality of service need. Including federal users would also help to reinforce the mutual benefits that will be derived over time if agencies participate actively in efforts to share underutilized bands currently occupied by DoD and other federal systems.

The Commission should also limit eligibility to a defined set of “mission critical” *uses* and not base eligibility strictly on the affiliation of the *user*. For example, under an assumption that hospitals are eligible, a nursing home might qualify because it has a medical unit that is actually operating sensitive medical equipment – but certainly not if it is merely using 3.5 GHz devices for the same sort of broadband connections or video routing applications that nearby

⁴¹ *Id.*

⁴² 47 C.F.R. § 90.7.

homeowners or businesses would operate on a GAA basis. In general, the eligibility should attach to the critical nature of the *use, not the user*.

PISC also agrees that Priority Access users, and particularly critical safety-of-life applications (e.g., latency or interference sensitive medical equipment), should not operate within coastal zones that are susceptible to harmful interference from high-power military radar pulses. Although PISC is confident that the SAS and the inherent insulation of very low-power operations that are contained *inside* a closed facility can protect Priority Access users from other low-power GAA users, it does not seem reasonable to assume that Priority Access users will be protected from high-power Incumbent Access systems.

3. Priority Access must not preclude GAA use absent evidence of actual harmful interference to a ‘mission critical’ indoor system

The *NPRM* appears to suggest that eligible “Priority Access users [that] are actually operating” can make a “reservation of frequencies for Priority Access use within a given location.”⁴³ PISC strongly opposes any requirement similar to the reservation system for wireless microphones enforced through the TV Bands Database that *preemptively* creates substantial bubbles of fallow spectrum around indoor sites that likely need no such protection due to the low-power of the GAA devices and attenuation of nearby GAA transmissions provided by the building itself. However justified the wireless microphone protection zones are in the TV bands below 700 MHz, at the frequency range (3.5 GHz) and transmit power limits (200 mW) proposed in the *NPRM*, the Commission should assume that the indoor/outdoor buffer will be protection enough absent testing and experience to the contrary.

⁴³ *NPRM* at ¶ 72.

PISC believes that no exclusion zones are needed to protect PA from harmful interference, unless attempts to resolve actual interference are unsuccessful. The rules should be clear that registered Priority Access uses can preempt only an interfering GAA use that disrupts or poses a bona fide risk to their “mission critical” operations. The Commission should establish a streamlined, online process for reporting and resolving reports of harmful interference to a registered Priority Access user. This can potentially be done through the same SAS portal that the Priority Access users will use to register and update their location and operations. PISC recognizes that however “streamlined” this process is made, disruptions for hours or days at certain “mission critical” facilities could be unacceptable. Against this, the Commission should weigh the cumulative cost of creating a Swiss cheese of large coverage holes across urban and suburban areas where large areas around every PA become wasted guard bands. At worst, PISC suggests that the Commission limit any PA “protection zones” in the SAS to critical “safety of life” systems – and not black out access to the band in an effort to provide absolute and preemptive protection for institutions (e.g., schools, libraries) where fleeting or temporary interference would not pose a compelling threat to public health or safety.

In addition, if the Commission determines that preemptive “protection zones” must be enforced to protect certain Priority Access uses, PISC suggests that the Commission channelize the band, at least for administrative purposes, and require that PA registrants in the SAS must specify the precise frequencies on which their “mission critical” equipment will be operating at that location (as well as the nature of the device). This will permit the SAS to protect only the portion of the PA band that actually needs protection at that location – and potentially avoid the waste of a considerable amount of spectrum capacity in aggregate across the nation, particularly

as GAA devices become more sophisticated and able to use or bond even non-contiguous spectrum across the band.

C. Tier 3: General Authorized Access

1. Exclusion zones should not be established to protect GAA devices or services from intermittent interference from offshore radars or other Federal operations

As noted above, PISC strongly supports the Commission’s proposal that “GAA use would be permitted in Priority Access Zones as well as areas where such devices would not cause harmful interference to incumbent operations, but where signals from incumbent operations could be expected to interfere with GAA uses on occasion (GAA Zones).”⁴⁴ We support the Commission’s proposal to define geographic exclusion zones for GAA users based *only* on the separation distances essential to protect Incumbent Access systems from harmful interference. A combination of the SAS, private sector technical innovation and consumer choice should determine what level of interference risk is tolerable to GAA users – and how best to mitigate the impact while taking advantage of the unused capacity in the band during the vast majority of the times when high-power radars are not present.

If the Commission concludes it is necessary to “protect the private sector from itself” to any degree, a more productive and spectrum-efficient alternative to a coastal exclusion zone (regardless how narrow) would be to require that GAA devices be multi-channel or multi-band, and employ dynamic frequency selection (DFS) if high-power interference from radar is detected. In fact, this potential “garage door opener” problem was considered explicitly during 2012 by both the PCAST and NTIA’s Commerce Spectrum Management Advisory Committee. Both Administration advisory bodies came to the same conclusion: that the problem is mitigated

⁴⁴ *NPRM* at ¶ 56.

by multi-band devices that can detect and avoid disabling interference from higher-power Federal systems, such as naval radar. The PCAST Report describes the SAS as automatically enforcing a “requirement of periodic and automatic connection to the database that will ensure no devices or networks are operating on out-of-date terms of use or without the capacity to be denied access to a particular band when necessary.” The Report goes on to state:

For this reason, . . . consumer devices will generally need to be ‘connected’ and multi-band. . . . [S]econdary and unlicensed users must be multi-band and capable of dynamic frequency selection, so that if a Federal primary user precludes use of a band (whether during an emergency, or permanently due to a system change), there is minimal risk of “stranded devices” or consumers whose devices suddenly become obsolete.⁴⁵

Similarly, the CSMAC has noted that the rules governing database access to TV band “white space” reserves the Commission’s ability to deny access to a particular channel in a particular market area at any time without disrupting the consumer’s ability to use other available channels:

Opportunistic access presumes that devices will increasingly be multi-band and capable of frequency agility. Devices certified for use on an unlicensed basis would not need to be tied to a particular frequency, even though this may make the devices more expensive than they otherwise might be. Bands may be able to be opened or closed for sharing – nationally, regionally, or locally – and even on short notice, without “stranding” any users or equipment.⁴⁶

Therefore, at a bare minimum, the Commission should permit devices and systems to operate inside the coastal exclusion zones if they can detect Navy radar, or use SAS notifications, and thereafter employ Dynamic Frequency Selection and hop instantly to another portion of the band (or to a different band, such as 2.4 GHz or 5 GHz unlicensed spectrum).

⁴⁵ PCAST Report at 102-103.

⁴⁶ “Unlicensed Uses Subcommittee Report,” Commerce Spectrum Management Advisory Committee, at 11 (adopted January 11, 2010).

2. GAA should be authorized to use the entire 150 MHz nationwide, subject only to exclusions necessary to protect incumbents and indoor Priority Access

PISC strongly supports the *NPRM*'s recommendation that "GAA users be permitted to operate across the entire 3.5 GHz Band in GAA Zones" and "in [a minimum of] at least 50 MHz in Priority Access Zones (depending on whether Priority Access services are in active use or not at a given location)."⁴⁷ In essence, we support the PCAST approach, adopted here, that assumes the Spectrum Access System is capable of enforcing any geographic exclusion or protection zones such that GAA uses can underlay the entire band and access any and all of the spectrum capacity that is not needed by the incumbent or prioritized licensees.

As discussed above, in relation to the Priority Access tier, we believe that it is essential to ensure that a majority of the band (100 megahertz or more) is available nationwide for at least low-power (small cell) GAA use – and, where possible, outside of urban areas for high-power (wide area) GAA use. Any exclusion or protection zones, whether for Incumbent Access users or Priority Access indoor use, should be defined based on real-world propagation and low-power use – and not over-protect higher tier uses at the cost of enormous lost spectrum capacity. In addition, we urge the Commission to consider permitting device makers and operators to rely on Transmit Power Control and limits on out of band emissions rather than static geographic exclusion zones chiseled in stone in the rules that do not vary with the evolving technological capability of devices. We believe the SAS contemplated in the *NPRM* will be capable of managing permissions that authorize *variable power* up to the full Part 15 limit, subject to lower limits in certain areas depending on the protections needed for registered Incumbent Access and Priority Access users.

⁴⁷ *NPRM* at ¶ 76.

PISC further agrees that GAA devices should be registered in SAS and query periodically depending on location. However, the Commission should strive to make this “registration” as easy and automatic as possible, both to minimize the burden on consumers and to better safeguard the intended protections for Incumbent Access systems. For example, if possible consumers should not need to register manually with an SAS database provider or even with the manufacturer of their device. It would be most foolproof and cost-effective if devices – upon activation – automatically connected to the SAS to authenticate their eligibility for activation, completing the registration process. The SAS would recognize the device – and be able to verify its FCC certification – if equipment makers and/or retailers are required to pre-register the devices. Ideally, any user fee for basic SAS permission services would be paid for in bulk, and in advance, by the manufacturer at that time (and included in the cost of the equipment sold to consumers). In fact, we ask the Commission to consider whether it is necessary for individual consumers to provide personal information if their device can be automatically registered and authenticated. What’s important is that the device is programmed to comply automatically with the Commission’s GAA rules; individuals should not need to provide personal identifying information unless the Commission reasonably determines it will be useful for recalling defective devices or otherwise enforcing interference protections in a significant number of cases.

3. Power limits and technical rules for small cell GAA and Priority Access devices should be as compatible as possible with Part 15

The Commission tentatively proposes to limit small-cell GAA and PA use to a maximum transmit power level of 200 milliwatts (1 Watt EIRP).⁴⁸ This seems extraordinarily low considering the propagation characteristics of the 3.5 GHz band. Wi-Fi devices operating on the

⁴⁸ *NRPM* at ¶ 131.

lower-frequency 2.4 GHz band are permitted to transmit at several times that power level. The question “how small is too small” for such cells is a difficult one to answer. However, PISC believes the Commission should err on the side of making the technical rules for the 3.5 GHz Band as compatible as possible with the Part 15 rules that apply to Wi-Fi and other uses of the 2.4 GHz band in particular. As a wideband underlay for opportunistic access and mobile device data offload, we believe that for the foreseeable future, the 3.5 GHz band and its Citizen’s Broadband Service will receive its most productive use if it can be integrated on the same device with the primary unlicensed bands employing the 802.11 family of standards. The installed base for the 802.11 family of standards – including soon the 802.11af standard for personal/portable devices operating on TV White Space spectrum – is huge, well-established and has a momentum that could stimulate greater demand for devices using a new *and compatible* 150 MHz of opportunistic spectrum.

PISC also has a concern that a unique license-by-rule regime for GAA will be more likely to be overly prescriptive, imposing uniquely difficult operating requirements in the name of a maximizing the comfort level of powerful Incumbent Access and Priority Access users. The Commission took this overly-protective approach in fashioning the opportunistic access rules for TV White Space spectrum, with the result that the service is not currently viable in a few of the largest cities (even though many vacant TV channels remain fallow) and substantial capacity on the band is not actually in use or authorized for use for any service.

D. PISC Opposes Qualcomm's Two-Tier Exclusionary Proposal

PISC strongly opposes a two-tier model under which General Authorized Access would not be permitted.⁴⁹ According to the *NPRM*, the spectrum not excluded to protect Incumbent Access users “would be licensed under criteria similar to those applicable to the proposed Priority Access tier.”⁵⁰ Presumably this could be managed one of two ways: Either each individual property holder could register for an exclusive license at their location; or an auction would result in one or more licensees who would act as a middleman to lease rights to operate at low power indoors, and possibly outdoors, to eligible users. In the first case, the SAS could be operated and charged separately to Priority Access licensees; or, in the second case, the holders of the exclusive spectrum licenses would presumably bundle the cost of the SAS into their leasing fees.

However such a two-tier “private commons” model might be established, it has several glaring defects compared to the Commission’s proposal to include an underlay of General Authorized Access on an opportunistic basis. First, the workings of the private marketplace have already rendered the judgment that this is a loser’s bet. For nearly a decade the Commission’s Secondary Market rules have both permitted and encouraged an existing carrier or entrant to implement this business model on exclusively-licensed spectrum. There have been no bidders let alone winners. Nor has any deep-pocketed investor sought to purchase spectrum on secondary markets to roll out this business model. In fact, even the idea’s advocates (Qualcomm, Alcatel Lucent, et al.) have not publicly promised to band together in a future auction to pay billions of dollars for spectrum that they would operate as a private commons.

⁴⁹ *Id.* at ¶ 84.

⁵⁰ *Id.*

Second, this would be a terrible outcome for institutions that would benefit from protected indoor use of the band for mission critical applications. Whereas the proposed Citizen's Broadband Service would extend the full benefits of protected indoor use to these institutions at the marginal cost of whatever the SAS operators will charge (most likely a one-time fee paid in bulk by equipment manufacturers, as anticipated vis-à-vis the TV Bands Database for White Space devices), the two-tier proposal described in the *NPRM* would insert a middleman to collect rents on the use of this public spectrum by mostly public sector and nonprofit critical service providers from now to eternity. Any one-time gain in public auction revenue would be paid out many times over in the decades ahead, by public safety agencies, hospitals and others, for a needless intermediary license owner. The Commission could not even ensure that all "mission critical" institutions had an opportunity to purchase this access without imposing a type of common carrier obligation on the exclusive licensee that would be resisted as meddling in that company's ability to maximize profits. The only necessary ingredient in either a two-tier or a three-tier variation is the SAS itself – and, as the Commission wisely decided with respect to the TV White Space, this function can be designated to competing marginal cost service providers (who, it appears, will make their profits through value-added services beneficial to consumers and unrelated to extracting spectrum rents).

Third, and most obviously, this proposal imposes an opportunity cost on society that is most likely many magnitudes larger than the private profit the exclusive licensees might derive. As Section II above describes, all evidence today suggests that the greatest value of another small cell band for consumers, ISPs of all kinds (mobile, cable, WISPs) and for adjacent markets (chips, devices, apps and services) will be the widespread adoption at the edge of GAA use. Both mobile device data offload and machine-to-machine innovations are far more likely to proliferate

in this band at massive scale than would be the case if the band is carved up into exclusive-licensing zones or access subscriptions with high transaction costs. The sort of positive externalities and innovation that have been steadily rising and well-documented benefits of the small cell and relatively wide-channel (20 MHz) band at 2.4 GHz suggest that another, similar band for open wireless access (so-called GAA in this context) will bring far greater public interest gains than would a more limited-use exclusively-licensed variation.

Finally, the proposal is wildly spectrum inefficient. It is very likely to leave most of the spectrum capacity on the band fallow. Either of the options above, by excluding GAA, would result in far lower usage. And although the first variation (selling exclusive licenses to property holders for indoor use) might spur demand among large institutional sites in some parts of the country, the second variation (auctioning exclusive geographic licenses to operate a “private common,” or to deploy a small-cell wide-area network instead) would likely result in a small number of winning bidders skimming the cream off of the five to ten largest urban centers – and leaving the band fallow or with scattered high-density-area use across the rest of the country. Even if the markets not hitting an auction reserve price were subsequently opened for GAA under a three-tier framework, the absence of a *national* market with the scope and scale possible under the Commission’s proposal would likely result in market failure. That again would be a tragic opportunity loss compared to the PCAST and Commission’s three-tier model.

IV. PISC SUPPORTS INTEGRATING 3650-3700 IN THE MULTI-TIER FRAMEWORK

PISC supports the Commission’s proposal to extend the proposed regulatory framework for the Citizens Broadband Service to include the 3650-3700 MHz band.⁵¹ Creating a contiguous 150 megahertz bloc of spectrum under the same license-by-rule approach and technical rules will

⁵¹ See *NRPM* at ¶¶ 78-80.

greatly benefit WISPs and other existing users of the 3650 MHz band, as well as new entrants and the general public interest.⁵² PISC strongly supports the Commission's proposal to reclassify current 3650-3700 MHz band licensees as General Authorized Access users able to operate across the entire 150 megahertz of the band, with the exception of locations excluded to protect Incumbent Access or Priority Access users. At the same time, we believe that the Higher Power Operation Zones should be extended to all non-urban areas, so that current WISPs and future rural broadband providers can operate across the entire 150 MHz from 3550 to 3700 MHz at current power levels on a GAA basis.

PISC believes that integrating all 150 megahertz under a common set of rules and governance by the dynamic Spectrum Access System would enable WISPs to better provide wireless broadband services, particularly in rural and remote areas, where broadband innovation and higher-quality wireless connections are most desperately needed. The Commission has identified 19 million Americans who do not have access to fixed broadband services; 14.5 million of these Americans reside in rural areas.⁵³ The entire 150 megahertz outside of urban areas should be designated as High Power Operating Zones in order to further facilitate broadband provision. Additionally, the wider channels and greater total capacity possible with 150 megahertz of spectrum provide greater throughput options for operators. The ability to offer far more bandwidth with roughly the same cost of capital promises more cost-effective, higher-speed service to more rural and small town homes and businesses.

⁵² *See Id.*

⁵³ *See Inquiry concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, and Possible Steps to Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications Act of 1996, as Amended by the Broadband Data Improvement Act*, Eighth Broadband Progress Report, 27 FCC Rcd 10342, 10370 (2012); *In the Matter of Connect America Fund*, Report and Order and Further Notice of Proposed Rulemaking, WC Docket No. 10-90, *et al.* (rel. Nov. 18, 2011), ¶ 4 n.3.

A common set of rules across 150 megahertz would create a welcome opportunity to simplify the regulatory regime for operators and consumers. The Commission should adopt common technical rules and reclassify “licensed light” operations as GAA, while allowing systems in non-urban HPOZ areas to operate at current maximum power levels. An integrated regulatory regime would reduce equipment costs by reducing the need for manufacturers to tailor equipment to work on two different but adjoining bands. Lower equipment costs and broader use of that equipment would foster innovation and improve the value proposition for rural broadband.

Common rules should also eliminate the unique rules specific to the lower 25 megahertz in the 3650-3700 MHz band, which would become obsolete. Those rules unnecessarily inhibit WISPs and other users, who must contend for the same limited amount of spectrum.⁵⁴ Further, common rules would also replace the current manual registration in the ULS system with an automated SAS database that seems likely to include value-added features over time to help WISPs and other users to coexist and coordinate their operations more automatically and efficiently. Utilizing an SAS database instead of the manual registration process in ULS would decrease conflicts and reduce waste caused by unused-but-registered stations, and eliminate the need to sift through and evaluate applications for registrations.

By applying the new 3550-3650 MHz rules to the “lightly licensed” operations currently on the 3650-3700 MHz – including the SAS database – the Commission would therefore improve both spectral efficiency and the safeguards against harmful interference to incumbent operations. PISC suggests that “lightly licensed” operations currently registered to use the 3650 MHz band should be allowed a substantial transition period (on the order of three to five years) after adoption of the Order, so as not to make obsolete existing equipment and to allow time for

⁵⁴ See *Wireless Operations in the 3650-3700 MHz Band*, Memorandum Opinion and Order, 22 FCC Rcd 10421, 10431 (2007).

equipment makers to mass produce updated base stations, customer devices and other equipment that conforms with the new rules and SAS authorization system.

V. CONCLUSION

The undersigned member groups of the Public Interest Spectrum Coalition applaud the Commission for moving so quickly and creatively to implement the short-term recommendation of the PCAST to open the 3550-3700 MHz bands for opportunistic General Authorized Access. Meeting the rapidly-rising demand for broadband data over mobile devices will ultimately require a greater focus on shared, dynamic access to underutilized bands, both federal and privately-licensed. The Commission's *NPRM* is a critical first step in a long-term effort to reorient the nation's spectrum policy toward *use* rather than exclusively reserved *non-use* of capacity on the public's infinitely-renewable spectrum resource. The Commission strikes the right balance, we believe, between protecting incumbent operations and facilitating private sector usage on a spectrally-efficient, small cell basis. PISC urges expedited consideration and implementation of the approach proposed in this *NPRM*.

Respectfully Submitted,

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February 20, 2013